said of the discoveries of which we are speaking; moreover, such an opinion, too frequently repeated, should be rejected. If one looks closely, it is possible to recognise that, in the majority of cases, not blind fortune is the aid of the happy discoverer, but the special attitude of mind and the scientific preparation he possesses. In the concrete case it is evident that Thomson, from the commencement of his researches, was unconsciously preparing himself for the grand discovery of the true nature of the kathode rays. It is sufficient in proof of this to cite his noteworthy memoir of 1881, relative to the electrical and magnetic effects produced by the motion of electrified bodies, for which Crookes's theory of radiant matter had furnished the inspiration.

The work published by Sir J. J. Thomson during recent years constitutes the complement and crown of his principal achievement. Thus, in a short time he was able to collect into a body of doctrine everything which relates to the propagation of electricity in gases, and of which his well-known treatise on the subject is the embodiment of the faith—a work that is consulted by all who conduct experimental researches in this field, which is very far from having yielded all its fruits. In this volume are treated with much detail the production of ions in gases, their disappearance, their velocities under certain contingencies, &c. Frequently the original experiments of the author and his students have rendered possible the completion of the explanation of a particular phenomenon, or put in evidence some new detail or the laws which it obeys. Moreover, making use of the facts thus accumulated and the relationship existing between them, Thomson had at his disposal the elements necessary to found a theory of electrical discharge more comprehensive than any previously proposed, which, although not yet complete and definitive, has enabled him to point out the relations between facts apparently disparate which previously could only be described separately and disconnectedly.

Quite recently the activity of the Cambridge physicist seems to have been concentrated on the study of the properties of the positive rays, and especially of the so-called canal rays. This is a field of studies in which several most daring workers (Wien, Stark, &c.) have amassed a rich harvest of most important results; none the less, J. J. Thomson, by the adoption of ingenious experimental arrangements, in part new, and especially by virtue of happily inspired and most original interpretations, has drawn, and continues to draw, from his researches consequences the import of which far surpasses the limits in which they might have been expected to be confined.

Of these researches physicists await with some impatience the publication of a treatise which shall present them not merely in order of date, but with that arrangement, clearness and concision which are precious characteristics of Thomson's writings.

However insufficient and incomplete, the foregoing considerations will help to make clear the signal value of Thomson's work. Such, at least, has been my intention. Although compelled to abandon an analysis of the extensive scientific productions of the great physicist, I trust that all will be, like myself, convinced that his work belongs to the category of those investigations which leave an indelible impress on the progress of science.

AUGUSTO RIGHI.

AN ENGLISH TEXT-BOOK OF PROTOZOOLOGY.

An Introduction to the Study of the Protozoa: with Special Reference to the Parasitic Forms. By Prof. E. A. Minchin, F.R.S. Pp. xi+520. (London: Edward Arnold, 1912.) Price 21s. net.

THIS work on the Protozoa by Prof. Minchin may be considered as an attempt to confine a knowledge of the philosophical and the practical side of the modern science of protozoology within the limits of one volume.

After discussing the one-celled organisms grouped for convenience under the term Protista, their modes of life are considered. Various types of nutrition—purely animal, plant-like, feeders on decaying matter, and finally parasitic methods—are described and illustrated. The "mutual aid" associations of the animal world known as symbiotic unions are charmingly portrayed, and in contrast the interrelations of hosts and parasites are set forth. A most interesting study in animal mechanics is presented, together with a broad account of the organisation of the Protozoa. To the cytologist there is much of interest in the chapter dealing with the nucleus and nuclear structure. The author draws a distinction "between organisms of the 'cellular' grade, with distinct nucleus and cytoplasm, and those of the 'bacterial' grade, in which the chromatin does not form a distinct nucleus." He considers that a "bacterial type of organism" is "not to be regarded as a cell, but as representing a condition antecedent to the evolution of the true cellular type of structure." Such a distinction seems somewhat arbitrary and unnatural, and tends to overlook the importance of intermediate forms.

© 1913 Nature Publishing Group

The problems of the propagation and perpetuation of races of organisms and the modes of transference of the parasitic forms are both of great interest and of economic importance. The parasites have multiplicative methods of reproduction which are necessary for the increase of their numbers within one host, while propagative forms are produced for their transference to other hosts. The function of syngamy (fusion of gametes) as a factor in keeping the tendency to variation within the specific limits is a view worthy of more attention. The many forms assumed by one organism (polymorphism) are traced as arising from adaptation to environment, to growth and development, and to sexual differentiation. The general part of the book closes with an interesting chapter dealing with the vital physiological phenomena shown by Protozoa.

Following the general consideration of the Protozoa, eight chapters are devoted to an account of their systematic grouping, and the enormous extent of the group can be realised by scanning the sequence of genera or by referring to the copious index. Prof. Minchin considers that two types of organisation prevail among the Protozoa. The simpler or Sarcodine type possesses no permanent locomotor organs when mature, although such may be present in its youth form. The second or Mastigophoran type, comprising organisms often of small size, has permanent locomotor organs, flagella, which are lost in the resting phases. Subdivisions of each group are numerous. The very diverse organisms among the Rhizopoda, such as the Amœbæ, the sun-animalcules (Helizoa), the chalk and ooze-formers known as Foraminifera and Radiolaria, and the Mycetozoa (claimed also by the botanist as the slime fungi or Myxomycetes), are all considered. Perhaps some newer illustrations would be an improvement here.

The bionomics of the flagellates are of much interest, whether the parasitic forms or the tiny inhabitants of ponds (also claimed by the botanist as Algæ) are under discussion. The interest of the medical man will be claimed by the accounts of the sleeping-sickness parasites, and the causes of such diseases as kala-azar, oriental sore, and malaria. The agriculturist should be interested in the parasites of red-water and East Coast fever, so fatal to cattle, as well as in the accounts of Coccidia, fish tumours, and silkworm disease. Incidentally, it may be mentioned that Prof. Minchin does not now accept the results of Schaudinn's researches on the parasites of the little owl.

Certain organisms, considered by some as doubtfully Protozoa, such as the Spirochætes, causing African tick fever and relapsing fever, and the bodies responsible for small-pox, are briefly considered in the concluding chapter. Those who care for possible genealogies and speculations will also find here an account of the possible evolution and ancestry of the Protozoa.

In conclusion, it is a pity that certain blemishes in the form of loose statements, some inconsistencies of nomenclature (for example, the use of Coccidium, Piroplasma), and slightly partisan views on some contentious subjects have been allowed to creep in and mar the book, but doubtless these will disappear in the second edition. We would also suggest that an increase in the number of illustrations would be a very great advantage, and this should not be incommensurate with the cost of the book (21*s.* net). Some rather old figures could be replaced by others embodying the results of more recent and accepted research. Criticisms of technique employed some years ago are obviously futile, inasmuch as the said technique was the best available at the time. Also we are distinctly of opinion that the systematic part of the book should be enlarged. But it must be recognised that the task before Prof. Minchin was an enormous one, and he is to be congratulated on the successful issue of the work.

CHEMISTRY AND ITS APPLICATIONS.

A Dictionary of Applied Chemistry. Revised and enlarged edition. By Sir Edward Thorpe, C.B., F.R.S., assisted by eminent contributors. Vol. ii. Pp. viii + 786. Vol. iii. Pp. viii + 789. (London: Longmans, Green and Co., 1912.) Price 45*s.* net per volume.

AS a notice of the first volume of the new edition of Thorpe's Dictionary appeared in the columns of NATURE for April 18, 1912, it is not necessary on the present occasion to do more than express cordial concurrence in the reviewer's high estimate of the character of the work and of the services rendered to the chemical world by the editor and his staff of contributors. In the two volumes before us the reader rather naturally turns first to those articles which specially illustrate the applications of science to industry, namely, those of which the subjects had not even come into practical existence at the date of the former edition. Metallography, for example, is one of these subjects, and is treated in a thoroughly masterly manner by Dr. Walter Rosenhain, of the National Physical Laboratory. Here is a subject which, originating fifty years ago in the microscopic study of rocks by Sorby, has been largely dependent for the advances

© 1913 Nature Publishing Group